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(54) Title: WATER WASHABLE PROTECTIVE COATING (57) Abstract A coating composition for producing a water washable, protective coating, comprising, by weight, 10-50 % of a mixture of at least two acrylic polymers each having different molecular weights, acid numbers, and glass transition temperatures. The composition includes water and an alkali, in an amount sufficient to maintain the composition at a pH in the range of 7.5 to 9.5 and is further characterized in that the average molecular weight of the mixture of the at least two acrylic polymers is in the range of approximately 35,000 to 100,000. The average acid number of the mixture is in the range of approximately 65 to 150 and the glass transition temperature of a coating produced by the evaporation of the water from the composition is in the range of 0 to 70 °C. <div style="text-align: center;"><p>1-8,15 1-15 09/815,874</p><p>12-15 1-15 09/693,366 KAT</p></div>		

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WATER WASHABLE PROTECTIVE COATING

This application claims priority of United States Provisional Application No. 60/057,359 filed August 26, 1997.

Field of the Invention

5 This invention relates generally to polymeric coatings. More particularly, the invention relates to an acrylic based protective coating which can be deposited from an aqueous solution, and which may be removed from an article by washing with neutral pH water.

Background of the Invention

10 Protective coatings are applied to automobiles and other articles to protect their surface finishes from dirt, scratches and other damage occurring during manufacture, shipping and storage. Such coatings should be tough, easy to apply, easy to remove and should not cause any harm to the article to which they are applied. Protective coatings typically comprise formulations including waxes,
15 polymers and the like. Most of such coatings are deposited from compositions including organic solvents therein. Removal of these coatings requires either organic solvents or wash water having a relatively alkaline pH. Organic solvents or non-neutral aqueous solutions can cause damage to various articles of manufacture, and complicate the formulation and handling of such coatings.

20 In addition to not causing harm to the article to which they are applied, protective coatings, particularly when applied over a clearcoat layer applied over a paint layer, must also resist etching and distorting the clearcoat layer following the exposure or application of heat to the protective coating. This situation

commonly arises during the application of trim components such as pin-striping when heat is applied directly to the protective coating in order to facilitate the adhesion of pin-striping to the surface of the automobile or when an automobile leaves the assembly plant without first having the protective coating removed and
5 is then exposed to heating by sunlight. Automobile manufacturers, therefore, require that these protective coatings resist chemical etching and distortion of the underlying clearcoat of the automobile upon exposure to heat.

Accordingly, there is a need for a protective coating formulation which is aqueous based, and which has a neutral or near neutral pH. It is further desirable
10 that this formulation provide a tough, durable, protective coating, but that the coating be removable from the surface by washing with neutral or near neutral pH water. It would be further desirable and advantageous to have a protective coating which will not etch nor distort the underlying clearcoat layer following exposure to heat. As will be described hereinbelow, the present invention provides a
15 composition fulfilling these criteria.

Detailed Description of the Invention

The protective coatings of the present invention are based upon acrylic polymers. As is known in the art, such materials include polymers of acrylic acid as well as substituted acrylic acids such as methyl methacrylate, as well as
20 copolymers such as styrene acrylic copolymers, and the like. The coatings of the present invention are durable, and resistant to ambient humidity; however, they are readily removed from a surface by washing with water having a neutral, or near

neutral, pH. In the context of the present disclosure, a near neutral pH refers to water having a pH which is only slightly acid or slightly alkaline. Generally, a near neutral pH is in the range of 4.5-9.5. It should also be noted that all formulations given herein are specified on a weight basis.

5 The protective coatings of the present invention are applied from an aqueous solution which has a pH in the range of 7.5-9.5. The compositions of the present invention may be applied by spraying, brushing, dipping or any other such coating technique. The final properties of the coating may be adjusted for various applications. In those instances where a relatively thick coating is required, a
10 higher viscosity coating solution is employed. Coatings which will encounter relatively low temperature conditions may be made relatively soft so as to resist cracking, while coatings which will be employed in high temperature conditions may be made to have a relatively high glass transition temperature, so that they will retain film strength at elevated temperatures.

15 Acrylic based materials have previously been employed in a variety of coating applications; however, it has been found, in accord with the present invention, that superior results are achieved when a protective coating is prepared from a blend of acrylic polymers, having different molecular weights, acid numbers and glass transition temperatures. Preferably, the composition of the
20 present will include, on a weight basis, approximately 10-50% of a mix of at least two acrylic polymers having different molecular weights, acid numbers and glass transition temperatures. The polymers are mixed with water, and an alkali, such

as sodium hydroxide, potassium hydroxide or mixtures thereof, in an amount, ranging from 0.5 to 2.5%, by weight, sufficient to maintain the composition at a pH of 7.5 to 9.5. In particular embodiments, the composition are characterized in that the average molecular weight of the polymers comprising the mixture is in the
5 range of approximately 35,000 to 100,000, and the average acid number of the mix is in the range of 65-150, and the glass transition temperature of a coating produced by the evaporation of water from the composition is in the range of 0-70°C.

In some particular embodiments of the invention, the mix of acrylic
10 polymers includes a first polymer having a molecular weight of no more than 2,000 and an acid number of at least 180, and more preferably 200. One example of such materials comprises the styrene acrylic copolymer sold by the B.F. Goodrich Corporation under the designation Carboset® 1161 or 1162. The aqueous solutions of these materials exhibit a decrease in viscosity at mildly
15 alkaline pHs, typically in the range of 8.0 - 9.5. This is an important feature of the present invention, because viscosity is often a limiting factor in determining the total solids content in coating compositions. Generally, users wish to have a high solids composition so as to minimize the amount of solution handled, and drying time; however, high solids compositions often have very high viscosities
20 preventing them from being readily applied in conventional coating processes. It has been found that inclusion of the low molecular, high acid number polymers serves to decrease the viscosity of the resultant solution, permitting the use of high

solids formulations. The low molecular weight, high acid number acrylic polymers are not good film formers, and for this reason, the compositions of the present invention will also include a higher molecular weight, lower acid number film forming polymer, in an amount sufficient such that the average molecular weight of the resultant composition is at least approximately 35,000.

In a preferred embodiment of the present invention, a coating composition for depositing a protective layer comprises, by weight, 10-50% of a mixture of at least two acrylic polymers having different molecular weights, acid numbers, and glass transition temperatures. The composition includes water and an alkali in an amount sufficient to maintain the composition at a pH in the range of 7.5 to 9.5. The composition is characterized in that the average molecular weight of the mixture of at least two acrylic polymers is in the range of 35,000 to 100,000, the average acid number of the mixture is in the range of 65 to 150, and the glass transition temperature of a coating produced by the evaporation of the water from the composition is in the range of 0 to 70°C. The alkali utilized in this embodiment preferably includes potassium hydroxide in an amount ranging from approximately 0.5-2.50%, by weight, of the composition. Additionally, the alkali can be sodium hydroxide in an amount ranging from approximately 0.5-2.50%, by weight, of the composition. In a most preferred embodiment, both potassium hydroxide and sodium hydroxide are included in the coating composition in an amount ranging from approximately 0.5-2.50%, by weight, of the composition. In this embodiment, the glass transition temperature of the coating composition

preferably ranges from approximately 0 to 10°C. Most preferably, the glass transition temperature of the coating composition is in the range of approximately 3 to 8°C. This embodiment of the present invention, referred to in Table 1 as 1019-118A, comprises, by weight, approximately 6.00% Carboset 525 resin, approximately 9.1% Carboset 515 resin, approximately 0.6% sodium hydroxide, and approximately 0.63% potassium hydroxide. The resins and alkali are dissolved in deionized water, in an amount of approximately 83% of the composition. The water is preferably heated to 70-80°C. In addition to the foregoing, the composition includes approximately 0.27% of a water softening ion chelating agent sold by the Ashland Corporation under the trade name Versene 100, approximately 0.3% of sodium lauryl sulfate, and approximately 0.02% of an anti-foaming agent sold under the trade name Foamaster 111. The resultant composition can be applied to an article by spraying, dipping, or brushing, and is subsequently dried to remove the water solvent to yield a durable and scratch resistant film. The overall Tg of the resultant film is approximately 4°C and the average molecular weight of the resin in the film is approximately 87,000.

Applicants have found that both the addition of potassium to the composition along with a Tg in the range of approximately 0-8°C are critical to eliminating the etching and distortion problem discussed above. Table 1 illustrates several embodiments of the subject coating composition.

Table 1

	Formulation 1019-118A	Formulation G-2000 CN 71965 Batch #20528	Formulation 1019-146	Formulation 1019-116	Formulation 1019-147
Deionized Water	83.07	73.79	83.05	77.63	82.38
NaOH Bead	0.6	2.28	0.56		0.55
KOH (Flake)	0.63		0.59	2.08	0.58
Versene 100	0.27	0.26	0.25	0.57	0.25
Carboset 525	6.01	3.73	2.42	0.91	0.80
Carboset 526		3.73		1.84	
Carboset 527			4.03		4.79
Carboset 1162					
Carboset 1161		10.28		3.65	
Carboset 515	9.12	5.29	8.86	12.47	10.39
Sodium Lauryl Sulfate	0.27	0.29	0.24	0.66	0.24
Tinuvin 1130 (UV absorber)		0.26			0.23
Foamaster 111	0.02		0.02		0.02
CS-1135 (antibacterial)		0.09		0.19	
TOTAL %	100	100	100	100	100
Avg MW	87675	61300	47740	29950	27050
Cal. Tg (C)	4.1	45	7.9	9.53	4.79

In another embodiment of the present invention, a coating composition for depositing a protective layer comprises, by weight, 1-5% of a first acrylic polymer which has a molecular weight in the range of 125,000 to 175,000, an acid number in the range of 80-120 and a glass transition temperature (T_g) in the range of 60-

80°C. The composition includes a second acrylic polymer, in an amount of 6-15%, and this second acrylic polymer has a molecular weight in the range of 1,000-2,000, an acid number of 180-230 and a Tg in the range of 70-110. The composition also includes a third acrylic polymer, in an amount of approximately 3-10%; and this third acrylic polymer has a molecular weight in the range of 175,000-250,000, an acid number of approximately 60-90, and a Tg in the range of 20-50. The composition also includes 3-10% of a fourth acrylic polymer having a molecular weight in the range of 5,000-10,000, an acid number in the range of 50-70 and a Tg of less than 0°C. The foregoing acrylic polymers are dissolved in water, together with an alkali, such as sodium hydroxide, potassium hydroxide, ammonia, triethanolamine or the like, in an amount sufficient to solubilize the polymers and maintain the composition at a pH in the range of 7.5-9.5.

The viscosity of the coating compositions will depend upon the particular application; but, typical viscosities are in the range of 30-1500 centipoise at 20°C, as measured by a Brookfield viscometer using a #1 spindle at 50 rpm.

The composition, in one embodiment, includes, by weight, approximately 10-30% of the foregoing acrylic resins. In one particularly preferred embodiment, the resins collectively total 20% by weight of the composition.

Any of the above-described compositions may further include other, ancillary ingredients such as water softening agents, chelating agents, surfactants and the like. These materials are typically present in relatively small amounts such

as 0.1-1.0%. The composition may also include other ancillary ingredients such as U.V. blocking agents, biocides, fungicides, defoamers, fragrances and colors.

In accord with the present invention, it has been found that the addition of a relatively small amount of emulsified wax enhances the resistance of the dried film to ambient humidity, but does not adversely affect rinsibility of the dried film. The wax is typically employed as an approximately 50% emulsion in water, and this emulsion is present in a weight amount of approximately 0.5-2.0% of the composition.

There are a variety of acrylic polymers which may be employed in the practice of the present invention. One group of materials comprises styrene-acrylic copolymers (also referred to as a styrenated acrylics) such as those sold by the B.F. Goodrich corporation under the designation Carboset. These materials are available in various grades; and Carboset 526 may be advantageously employed as the first acrylic polymer; Carboset 1161 or 1162 may be employed as the second acrylic polymer; Carboset 525 may be employed as the third acrylic polymer, and Carboset 515 may be employed as the fourth acrylic polymer. Other similar materials are available from the S.C. Johnson corporation under the designation Joncryl, or from ICI Inc. under the name Zeneca. Other polymer suppliers such as Rhom & Haas and Rhone-Poulenc also sell similar materials.

One illustrative, embodied composition of the present invention comprises, by weight, 1.2% Carboset 526 resin, 9.0% Carboset 1161 resin, 4.0% Carboset 525 resin, and 4.0% Carboset 515 resin. The resins are dissolved in deionized

water, in an amount of 79% of the composition. The water is preferably heated to 70-80°C, and includes approximately 2.2% by weight of the composition of a 50% solution of sodium hydroxide to facilitate dissolution of the resins, and to maintain the pH of the resultant solution in the range of approximately 7.5-9.5.

5 In addition to the foregoing, the composition includes 0.3% of water softening and ion chelating agent sold by the Ashland corporation under the designation Versene 100, and 0.3% of sodium lauryl sulfate, which is used as a wetting agent and rinse aid.

10 The foregoing compositions may be applied to an article by spraying, dipping or brushing, and is subsequently dried to remove the water solvent therefrom. The resultant film is durable and scratch resistant. The overall Tg of the resultant film is approximately 53°C and the average molecular weight of the resin in the film is approximately 59,000.

15 Another embodied composition of the present invention comprises, on a weight basis, 2.38% Carboset 525 resin; 1.59% Carboset 526 resin; 3.97% Carboset 527 resin; 2.38% Carboset 1162 resin; 7.94% Carboset 1161 resin; 6.59% Carboset 515 resin; 0.27% sodium lauryl sulfate surfactant and .36% of the above-referenced Versene 100 water softening agent. The resins are dissolved in deionized water in an amount of 69.21% of the composition and the water
20 includes 2.67% by weight of sodium hydroxide. The average molecular weight of this composition is approximately 38,000, and the glass transition temperature of the resultant dried film is calculated to be approximately 40°C.

Another coating composition comprises, on a weight basis, 2.89% Carboset 525 resin; 0.87% Carboset 526 resin; 8.67% Carboset 1161 resin and 3.92% Carboset 515 resin. The resins are dissolved in 80.72% de-ionized water, along with 1.82% sodium hydroxide. The composition also includes 0.36% Versene 100 water softening agent and 0.28% sodium lauryl sulfate, as in previous examples. This particular composition also includes 0.23% of an ultra-violet light absorbing agent sold under the designation Tinuvin 1130, and 0.24% of an anti-bacterial agent sold under the designation CS-1135. These last two agents increase the stability of the resultant film to ambient conditions. The average molecular weight of the resultant composition is approximately 41719, and the glass transition temperature of the resultant film produced thereby is calculated to be approximately 50°C.

As noted above, the proportions of the various resins may be varied within the listed ranges so as to adjust the overall performance of the film. For example, increase in the amount of the low molecular weight Carboset 515 resin will soften the resultant film, while increasing the amount of the relatively high molecular weight Carboset 525 resin will harden the film. It has also been found that substituting Carboset 1162 for Carboset 1161 will produce a somewhat harder film, more useful for high temperature applications. Also, it has been found that the viscosity can be adjusted by varying the relative amounts of the resin components. The pH can be adjusted by adjusting the concentration of alkali in the composition. While the foregoing compositions include Carboset resins, sold

by the B.F. Goodrich Corporation, similar resins are available from other suppliers, and may be employed in the present invention. Also, as noted above, a relatively small amount of wax emulsion may be added to the material to enhance resistance to humidity. Surprisingly enough, addition of this emulsion
5 does not detract from the water rinsibility of the film.

In addition, the drying time of the film can be decreased by replacing up to half of the water with an alcohol such as isopropanol or ethanol.

The following examples are given for the purpose of illustrating various embodiments of the invention and are not meant to limit the present invention in
10 any way.

EXAMPLES

Example 1 - Removability of Coating from an Article

Standard: GM 9982223 04/94
Material: G-2000 Anti-Scratch Coating Batch #20528 - See Table 1
15 for Composition

Paint System Identification:

A.	Phosphate:	B952 P60	B:	Phosphate:	B952 P60
	ECoat:	ED5000		ECoat:	ED5050A
	Basecoat:	542AB921 Black		Basecoat:	408AB921 Black
20	Clearcoat:	RK 8010 Gen 4A		Clearcoat:	RK8018

Transit Film Build Conditions:

Normal = N
Low = L
High = H

Removal Procedure:

Panels are rinsed under room temperature water for up to five minutes and then blown off with air after exposures

- 5 **Evaluation 3.3.1:** Moisture Resistance
 Test Method: GM 4465P 07/95
 Exposure: 96 Hours
 Recovery: 24 Hours
 Exposure Chamber: Singleton Model 24 (ACT #87)
- 10 Examination: Visual examination for loss of film integrity of softening
- Rating Scale: 0 = No effect (etching) from contaminants
 1 = Trace/slight effect
 2 = Moderate effect
 3 = Pronounced/severe effect
- 15 Moisture Resistance Test Data:
- | <u>ID</u> | <u>Film Integrity</u> | <u>Softening</u> |
|-----------|---------------------------|------------------|
| A1N | No transit film remaining | n/a |
| B1N | No transit film remaining | n/a |
- 20 The results of this example demonstrate that a film coating in accordance with the invention can be rinsed from an article with water.

Example 2 - Discoloration or Cracking

- Standard: GM 9982223 04/94
 Material: G-2000 Anti-Scratch Coating Batch #20528 - See Table 1 for Composition
- 25 **Evaluation 3.3.2:** Heat Age
 Exposure: 336 hours at $82 \pm 2^\circ\text{C}$
 Exposure Chamber: Despatch LDB 2-27-4 Oven (ACT #207)
- Examinations: Visual examination for discoloration or cracking
 Removability

Rating Scale: 0 = No effect (etching) from contaminants
 1 = Trace/slight effect
 2 = Moderate effect
 3 = Pronounced/severe effect

5 Heat Age Test Data:

ID	<u>Visual Change</u>	<u>Removability</u>
A1L	0	0
A1N	0	0
A1H	0	0
10 B1L	0	0
B1N	0	0
B1H	0	0

15 The results of this example demonstrate that a coating in accordance with the present invention was removable and did not discolor an article after prolonged exposure to heat.

Example 3 - Resistance to Changes in the Coated Film Due to U.V. Exposure

20 **Evaluation 3.3.7:** QUV Exposure
 Test Method: GM 9125P 07/91
 Material: G-2000 Anti-Scratch Coating Batch #20528 - See
 Table 1 for Composition

Cycle: 8 hours UV at $70 \pm 2^\circ\text{C}$
 4 hours condensation at $50 \pm 2^\circ\text{C}$

Exposure 250 and 500 hours

Exposure Chamber: Atlas UV-CON Cabinet (ACT #52)

25 **Examinations:** Visual examination for marring, cracking,
 discoloration, etc.
 Removability

QUV Exposure Test Data:

	<u>ID</u>	<u>Exposure</u>	<u>Visual Change</u>	<u>Removability</u>
	AIN	250 Hours	0	*
	AIH	250 Hours	0	*
5	BIN	250 Hours	0	*
	BIH	250 Hours	0	*
	AIN	500 Hours	0	*
	AIH	500 Hours	0	*
10	BIN	500 Hours	0	*
	BIH	500 Hours	0	*

*No transit film remained on the panels after exposure

The results illustrated in this example demonstrate that a coating composition in accordance with the present invention resists changes due to prolonged U.V. light exposure.

15 Example 4 - Resistance to Chemical Etching

Evaluation #4: Resistance to Chemical Etching
Test Method: GM 9533P 07/95 Method 3
Material: G-2000 Anti-Scratch Coating Batch #20528 - See Table 1 for Composition

20 **Procedure:** Apply 0.05 mL of test solution to each panel. Leave at room temperature for 30 minutes, then place in preheated chambers at specified temperatures for 30 minutes. Remove material and evaluate.

Test Temperatures: $50 \pm 2^\circ\text{C}$, $60 \pm 2^\circ\text{C}$, $70 \pm 2^\circ\text{C}$, $80 \pm 2^\circ\text{C}$

25 **50°C Chamber:** Cincinnati Sub Zero (ACT #579)
60°C Chamber: Hotpack (ACT #7)
70°C Chamber: Thermotron Model SM-32C (ACT #175)
80°C Chamber: Thermotron Model SM-32C (ACT #26)

Examination: Visual examination for change

Claims

- 1 1. A coating composition for producing a water washable, protective
2 coating, said composition comprising, by weight:
3 10-50% of a mixture of at least two acrylic polymers, said polymers having
4 different molecular weights, acid numbers and glass transition temperatures;
5 water; and
6 an alkali, in an amount sufficient to maintain the composition at a pH in
7 the range of 7.5 to 9.5, said composition further characterized in that the average
8 molecular weight of said mixture of at least two acrylic polymers is in the range
9 of 35,000 to 100,000, the average acid number of said mixture is in the range of
10 65 to 150, and the glass transition temperature of a coating produced by the
11 evaporation of the water from said composition is in the range 0 to 70°C.
- 1 2. A composition as in claim 1, wherein said alkali includes potassium
2 hydroxide.
- 1 3. A composition as in claim 1, wherein said alkali includes sodium
2 hydroxide.
- 1 4. A composition as in claim 3, wherein said alkali includes a mixture
2 of potassium and sodium.

1 5. A composition as in claim 2, wherein said potassium hydroxide
2 comprises, by weight, 0.5-2.50% of said composition.

1 6. A composition as in claim 3, wherein said sodium hydroxide
2 comprises, by weight, 0.5-2.50% of said composition.

1 7. A composition as in claim 1, wherein the glass transition temperature
2 of said coating composition is in the range of approximately 0 to 10°C.

1 8. A composition as in claim 7, wherein the glass transition temperature
2 of said coating composition is in the range of approximately 3 to 8°C.

1 9. A composition as in claim 1, wherein at least one of said acrylic
2 polymers is a styrenated acrylic polymer.

1 10. A composition as in claim 1, wherein all of said acrylic polymers are
2 styrenated acrylic polymers.

1 11. A composition as in claim 1, having a viscosity in the range of 30 to
2 1500 centipoise at 20°C.

1 12. A composition as in claim 1, wherein said polymer mix comprises, by
2 weight, 10-35% of said composition.

1 13. A composition as in claim 1, further including, by weight, 0.5-2.0%
2 of an emulsion of 50% wax in water.

1 14. A composition as in claim 1, further including 0.1-1.0% of a chelating
2 agent.

1 15. A composition as in claim 1, further including, by weight, 0.1-1.0%
2 of a surfactant.

1 16. A composition as in claim 1, further including an auxiliary ingredient
2 selected from the group consisting of: UV blocking agents, biocides, fungicides,
3 defoamers, fragrances, coloring agents, and combinations thereof.

1 17. A composition as in claim 1 including a third acrylic polymer.

1 18. A composition as in claim 17, wherein said first, second, and third
2 acrylic polymers total, by weight, approximately 15% of said composition.

1 19. A composition as in claim 1, further including an alcohol to decrease
2 the drying time of said coating.

1 20. A dried film prepared by evaporating water from the composition of
2 claim 1.

1 21. A dried film as in claim 20, wherein the Tg of said film is in the range
2 of approximately 0 to 10°C.

1 22. A coating composition for producing a water washable, protective
2 coating, said composition comprising, by weight:

3 1-5% of a first acrylic polymer having a molecular weight in the range of
4 125,000-175,000, an acid number in the range of 80-120, and a Tg in
5 the range of 60-80°C;

6 6-15% of a second acrylic polymer having a molecular weight in the range
7 of 1,000-2,000, an acid number in the range of 180-230, and a Tg in
8 the range of 70-110°C;

9 3-10% of a third acrylic polymer having a molecular weight in the range
10 of 175,000-250,000, an acid number in the range of 60-90, and a Tg
11 in the range of 20-50°C;

12 3-10% of a fourth acrylic polymer having a molecular weight in the range
13 of 5,000-10,000, an acid number in the range of 50-70, and a Tg of
14 less than 0°C;
15 water; and
16 an alkali in an amount sufficient to maintain the composition at a pH in
17 the range of 7.5-9.5.

1 23. A composition as in claim 22, wherein said first, second, third and
2 fourth acrylic polymers collectively total, by weight, 10-40% of said composition.

1 24. A composition as in claim 22, wherein said first, second, third and
2 fourth acrylic polymers total, by weight, 20% of said composition.

1 25. A composition as in claim 22, having a viscosity in the range of 30-
2 1500 centipoise at 20°C.

1 26. A composition as in claim 22, further including, by weight, 0.5-2.0%
2 of an emulsion of 50% wax in water.

1 27. A composition as in claim 22, further including 0.1-1.0% of a
2 chelating agent.

1 28. A composition as in claim 22, further including, by weight, 0.1-1.0%
2 of a surfactant.

1 29. A composition as in claim 22, further including an auxiliary ingredient
2 selected from the group consisting of: UV blocking agents, biocides, fungicides,
3 defoamers, fragrances, coloring agents, and combinations thereof.

1 30. A composition as in claim 21, further including an alcohol to decrease
2 the drying time of said coating.

3 31. A composition as in claim 22, comprising, by weight, 1.2% of said
4 first acrylic polymer; 9.0% of said second acrylic polymer; 4.0% of said third
5 acrylic polymer; 4.0% of said fourth acrylic polymer; 0.3% of a chelating agent;
6 and 0.3% of a surfactant.

1 32. A dried film prepared by evaporating water from the composition of
2 claim 22.

1 33. A dried film as in claim 32, wherein the Tg of said film is in the range
2 of 40-70°C.

1 34. A water washable, protective coating comprising, by weight:

2 5-25% of a first acrylic polymer having a molecular weight in the range of
3 125,000-175,000, an acid number in the range of 80-120, and a Tg in
4 the range of 60-80°C;
5 30-60% of a second acrylic polymer having a molecular weight in the
6 range of 1,000-2,000, an acid number in the range of 180-230, and a
7 Tg in the range of 70-110°C;
8 15-50% of a third acrylic polymer having a molecular weight in the range
9 of 175,000-250,000, an acid number in the range of 60-90, and a Tg
10 in the range of 20-50°C; and
11 15-50% of a fourth acrylic polymer having a molecular weight in the range
12 of 5,000-10,000, an acid number in the range of 50-70, and a Tg of
13 less than 0°C.

1 35. A coating as in claim 34, further including, by weight, 1-5% wax.

1 36. A composition as in claim 34, further including an auxiliary material
2 therein selected from the group consisting of: surfactants, chelating agents, UV
3 blocking agents, biocides, fungicides, coloring agents, fragrances, and
4 combinations thereof.

1 37. A composition as in claim 34, further including an alcohol to decrease
2 the drying time of said coating.

1 38. A coating composition for producing a water washable, protective
2 coating, said composition comprising, by weight:
3 10-50% of a mix of at least two acrylic polymers, said polymers having
4 different molecular weights, acid numbers and glass transition
5 temperatures;
6 water; and
7 an alkali, in an amount sufficient to maintain the composition at a pH in
8 the range of 7.5 to 9.5, said composition further characterized in that
9 the average molecular weight of said mix of at least two acrylic
10 polymers is in the range of 35,000 to 70,000, the average acid number
11 of said mix is in the range of 65 to 150, and the glass transition
12 temperature of a coating produced by the evaporation of the water
13 from said composition is in the range 40 to 70°C.

1 39. A composition as in claim 38, having a viscosity in the range of 30 to
2 1500 centipoise at 20°C.

1 40. A composition as in claim 38, wherein said polymer mix comprises,
2 by weight, 10-35% of said composition.